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The side effects of COVID-19 vaccines: A cross-sectional study in the eastern region of Libya

Arwa Benkhaial[1*], Asmaa A. Rabee[2], Raga A. Elzahaf [3], Iman Elmahdi[1], Fatma Benkhaial[4], Tunis Meidan[4]

[1]Department of Pharmacology and Toxicology, Faculty of Pharmacy, University of Benghazi, Benghazi, Libya.
[2]Department of Pharmacology, Faculty of Medicine, University of Derna, Derna, Libya.
[3]Public Health Department, College of Medical Technology, Derna, Libya.
[4]Department of Family Medicine, Faculty of Medicine, University of Benghazi, Benghazi, Libya.

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Corresponding Author:

Dr Arwa Benkhaial

Department of Pharmacology and Toxicology, Faculty of Pharmacy, University of Benghazi, Benghazi, Libya.

Email: arwa.benkhaial@uob.edu.ly

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ABSTRACT

Purpose: Patient-reported data is an important source of safety information. The aim of this study was to describe the side effects of COVID-19 vaccines used in Libya, compare them, and find the association of these with different factors.

Materials and Methods: A cross-sectional study was conducted in the eastern part of Libya. Adults who got one or two doses of any COVID-19 vaccine were included. The questionnaire was distributed online via social media, and also distributed as paper form to increase the responses.

Results: In total, 1779 adults, (53.7%) females completed the questionnaire. The mean age of participants was 39.87±14.99. Generally, females experienced side effects slightly higher compared to males (75.7% and 68.8% respectively). Overall, the prevalence of side effects was slightly higher in participants aged ≤40 years compared to those aged >40 years (76.5% and 66.6% respectively). However, this difference was found to be statistically significant (p=0.001). The side effects were more common among those previously infected with COVID-19 than those not (78.5% and 21.5%, respectively; p=0.001). The side effects were more common among those, who received the Sputnik V and the Sinopharm vaccine compared to other types. The most common side effect was fever (41.1%), (47.3%) for the Sputnik V vaccine.

Conclusion: The side effects of COVID-19 vaccines used in Libya are generally mild and self-limiting. The most common side effect was fever, which was more prominent among females and the younger age group of participants. Also, the side effects were more common among those, who received the Sputnik V vaccine. *(Open J Bio Med Res 2022;1:19-27.)*

Keywords

COVID-19 vaccines, Side effects, Adverse effects, Libya, Pharmacovigilance.

AUDIOABSTRACT

INTRODUCTION

Since the beginning of the Coronavirus infection, human health has been affected worldwide. Meanwhile governments have taken safety measures to limit its spread. Due to this global emergency state of public health, urgent efforts have been made to develop and test the efficacy and safety of vaccines. For this reason, pharmaceutical companies have been engaged in a struggle to manufacture safe and effective vaccines to limit the spread of this infection.[1]

Many COVID-19 vaccines are being developed but only a few are awarded emergency use approval (EUA) in different countries. As of 12 January 2022, nine COVID-19 vaccines are validated for use by the WHO and given Emergency Use Listing (EUL). These include the Pfizer/BioNTech Comirnaty vaccine, the SII/COVISHIELD and AstraZeneca/ AZD1222 vaccine, Janssen/Ad26.COV 2.S vaccine, the Moderna COVID-19 vaccine (mRNA 1273), the Sinopharm COVID-19 vaccine, Sinovac-CoronaVac vaccine, Bharat

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Biotech BBV152 COVAXIN vaccine, Covovax (NVX-CoV2373) vaccine, and Nuvaxovid (NVX-CoV2373) vaccine.[2] According to the COVID-19 vaccine tracker website six vaccines are approved for use in Libya, the Moderna Spikevax, Pfizer/BioNTech Comirnaty, Gamaleya Sputnik V, Janssen (Johnson & Johnson) Ad26.COV2.S, Oxford/AstraZeneca Vaxzevria, and Sinovac CoronaVac.[3] But those actually used in the vaccination campaigns in Libya are the Pfizer/BioNTech Comirnaty vaccine, AstraZeneca/AZD1222 vaccine, Sinopharm COVID-19 vaccine, Sinovac-CoronaVac vaccine, and the Sputnik V vaccine.[4] According to the National Center for Disease Control, Libya, the total number of people who are vaccinated is 3,065,973 (on 31 January 2022).[4]

Most of these vaccines have shown an acceptable level of efficacy and safety in randomized clinical trials.[5-9] Approximately 50% to 90% of participants experience some adverse effects.[5,6,10] including injection site events (e.g., pain, redness, swelling) and systemic effects (e.g., fatigue, headache, muscle or joint pain), with rare serious adverse events.[10,11]

As a result of the crucial need of preventing the spread of the COVID-19 infection, the standard approval procedures of new vaccines could not be followed. Therefore, large cohort studies may provide a tool for post-marketing surveillance of these vaccines.[12] This gives a strong rationale for collecting comprehensive scientific evidence about these vaccines by monitoring adverse effects in the population after vaccination.[12,13] Therefore, real-world patient-reported data on adverse effects after receiving COVID-19 vaccination can be used as a source of pharmacovigilance information about these vaccines. Moreover public, especially in developing countries, do not prefer to take these vaccines, due to fear of their side effects. Accordingly, studies are necessary to increase people's awareness and acceptance of COVID-19 vaccination. Therefore, the objectives of this study were: to describe the side effects of COVID-19 vaccines used in Libya, to compare the side effects profile of these vaccines, and finally to find out the association of individual side effects with different factors, e.g., gender and age, etc.

MATERIALS AND METHODS

A cross-sectional study has been conducted in the eastern part of Libya. The target population was people at/over 18 years old of both genders who got one or two doses of any COVID-19 vaccines. The ethical approval was taken from the Libyan national committee for biosafety and bioethics.

The number of participants required to be included was calculated according to Raosoft software.[14] The assumptions were: there is 95% power at the 3% significant level to find a 50% response distribution. It was therefore calculated that a minimum sample size of 1067. However, to reduce sampling bias in our method as this study was based on an online questionnaire distributed via social media, we increased the sample size to include 1779 participants.

The questionnaire was designed and revised according to the expected adverse effects of the different COVID-19 vaccines after the literature review. It started with demographic data, e.g., gender, education level, income, city, chronic disease history, and previous COVID-19 infections. Followed by a part that includes specific questions regarding assessing the adverse effects of COVID-19 vaccines of first and second doses. The questionnaire was designed on Google form as closed questions with some obligatory answered items to avoid getting incomplete responses or data. The Arabic version of the questionnaire was distributed online via social media, and also as paper through face to face interviews to increase the number of responses.

Data collected in Google forms were exported to a Microsoft Excel file, which was directly imported into IBM SPSS® 26.0 for statistical analysis. Descriptive statistics were used to describe the socio-demographic characteristics of participants. Associations between categorical variables were evaluated by performing the Pearson chi-square test. The statistical significance level was set at $P < 0.05$.

RESULTS

In total, 1779 adults, 955 (53.7%) females who had been vaccinated completed the questionnaire. The mean age of participants was 39.87±14.99, more than half 1051 (59.1%) of them being 40 years old or below ranged between 18 and 92 years, with 758 (42.6%) having family income range from 500 to 1000 LD. More than half of the study participants reported having a university degree 1051 (59.1%).

The experience of side effects was slightly higher in females compared to males (75.7% and 68.8%, respectively). However, this difference was found to be statistically significant (P=0.001). Overall, the prevalence of side effects was slightly higher in participants aged ≤40 years as compared to those aged >40 years (76.5% and 66.6%, respectively). However, this difference was found to be statistically significant (P=0.001).

The side effects due to the COVID-19 vaccine were more common among participants, who were previously infected with COVID-19 compared to the opposite group (78.5% and 21.5%, respectively; P=0.001). Among the study population, only 419 (23.6%) had a history of confirmed COVID-19 infection (Table 1).

Table 1. The association of side effects of COVID-19 vaccines with demographic characteristics of study participants.

Demographic data	No. (%)	Experience any symptoms after taking the vaccination		P-value
		Yes No. (%)	No No. (%)	
Age				
≤40 years	1051(59.1)	817(76.5)	251(23.5)	0.001
>40 years	728(40.9)	491(66.6)	246(33.4)	
Gender				
Male	824(46.3)	577(68.8)	262(31.2)	0.001
Female	955(53.7)	731 (75.7)	235(24.3)	
Educational level				
Uneducated	105(5.9)	79(75.2)	26(24.8)	
Elementary education	155(8.7)	97(62.6)	58(37.4)	
Secondary school	238(13.4)	169(71.0)	69(29.0)	0.030
University	1051(59.1)	783(74.5)	268(25.5)	
Postgraduate	230(12.9)	171(74.3)	59(25.7)	
Family income				
Less than 500 LD	187(10.5)	123(65.8)	187(10.5)	
500 to 1000 LD	758(42.6)	569(75.1)	758(42.6)	0.008
1000 to 2000 LD	512(28.8)	387(75.6)	512(28.8)	
More than 2000 LD	322(18.1)	220(68.3)	322(18.1)	
Previous infection with COVID-19				
Yes	419(23.6)	329(78.5)	90(21.5)	
Probably	1007(56.6)	268(75.9)	85(24.1)	0.001
No	353(19.8)	702(69.7)	305(30.3)	

LD: Libyan Dinar.

Four hundred ninety-three (27.7%) of the participants had a history of chronic disease, 246 suffered from hypertension, 233 of them suffered from diabetes, 71 suffered from asthma and 70 suffered from heart disease. No significant association was found with participants who had a chronic disease and side effects of the COVID-19 vaccines (P>0.05). (Table 2).

Most of the participants reported that they know the type of vaccine they took. More than half 1025(57.6%) of the participants reported they received only the first dose and 754 (42.4%) received the first and second dose. The majority 783(44%) received the Sputnik V vaccine, 397(22.3%) received the AstraZeneca vaccine, 335(18.8%) received the Sinopharm vaccine and 15(0.8%) received the Moderna vaccine outside Libya. However, 16 (0.9%) did not know the type of vaccine they received (Table 3).

Seven hundred and fifty-four of the participants (42.4%) received the second dose of vaccine, 76 (10%) of them reported the type of the vaccine they received and the majority 50 (65.7%) of them said they got the AstraZeneca instead of the Sputnik V second dose.

The side effects due to the COVID-19 vaccine were more common among participants, who received the Sputnik V and the Sinopharm compared to other types. This difference was found to be statistically significant (P=0.001).

A total of 1299 (73%) participants reported at least one side effect following vaccination. Nearly, two-third (60%) of the participants experienced mild side effects, whereas 34% experienced moderate side effects and 6% experienced severe side effects after receiving the first and second dose of the vaccine.

Table 2. The association of side effects of COVID-19 vaccines with chronic disease among participants (n=620).

Chronic Disease	No. (%)	Experience of any side effects after vaccination		P-value
		Yes No. (%)	No No. (%)	
Hypertension	246(13.8)	177(72.0)	69(28.0)	0.699*
Diabetes Mellitus	233(13.1)	160(68.7)	73(31.3)	0.124*
Asthma	71(4.0)	59(83.1)	12(16.9)	0.560
Heart Disease	70(3.9)	55(78.6)	15(21.4)	0.337*

*Fisher's exact test.

Table 3. The association of the side effects of the COVID-19 vaccine with the type of the vaccine.

Type of Vaccine	No. (%)	Experience of side effects after vaccination		P-value
		Yes No. (%)	No No. (%)	
Sputnik V	783(44.0)	592(75.6)	191(24.4)	
AstraZeneca	397(22.3)	65(16.4)	332(83.6)	
Sinopharm	335(18.8)	185(55.2)	150(44.8)	
Sinovac	127(7.1)	78(61.4)	49(38.6)	0.001
Pfizer	783(44.0)	592(75.6)	191(24.4)	
Moderna*	397(22.3)	65(16.4)	332(83.6)	
Do not know the type of vaccine	335(18.8)	185(55.2)	150(44.8)	

* Vaccinated outside Libya.

Nine hundred and forty-four (72.6%) of the participants reported the onset of the COVID-19 vaccine side effects from the first day of vaccination, 325 (25%) reported them from the second day of vaccination, and 41 (3%) from the third day onwards. 1026 (78%) of the side effect symptoms lasted for one day or less, whereas 290 (22%) lasted three days or more.

The most common side effect was fever after vaccination 731 (41.1%), 346 (47.3%) for Sputnik V. It has been shown that the dose of Sputnik V vaccine 346 (47.3%) was significantly associated with higher reports of fever, general fatigue, joint pain, dizziness, nausea, pain, swelling, and itching at the injection site (P<0.05). No significant association was found among the other symptoms following vaccination.

Fever, headache, general fatigue, breathing difficulty, pain at the injection site, joint pain, swelling of the injection site were the most frequently reported side effect among participants. Other side effects include dizziness, nausea, and itching at the injection site. Less common side effects reported were diarrhea, redness at the injection site, cough, allergic reaction, and blood clots reported by four participants presented in Table 4.

A chi-squared test was also performed to find out the association of individual side effects with gender and age. Female participants 398 (59.8%) experienced significantly more fatigue compared to male participants 267 (40.2%) (P=0.001). Headache, fever, dizziness, joint pain, breathing difficulty, nausea, pain, swelling, itching, and redness at the injection site were also significantly more among females compared to males (P< 0.05) (Table 5).

Fever was found to be significantly more prevalent among the ≤ 40 years 479 (65.5%) and the > 40 years 252 (34.5%) (P= 0.001). In the age group of ≤ 40 years, general fatigue, pain at the injection, joint pain, dizziness, and nausea were also significantly more prevalent compared to the age group of > 40 years (P<0.05). No significant association was found among the other side effects following vaccination.

Sixty percent of participants experienced mild side effects, whereas 34% experienced moderate side effects and 6% experienced severe side effects after receiving the first and second dose of vaccine. The severity of post-vaccine side effects was found to be significantly higher in females in comparison to males and higher in the age group ≤ 40 years compared to higher age (Table 6). All of the reported side effects were self-limiting without any specialized care needed except for 37 (2.85%) participants who were admitted to hospital due to the severity of the symptoms, 20 (1.54%) suffered from shortness of breath, 4 (0.3%) from blood clots, the clots appeared from the first week of taking the vaccination, and 27 (2.07%) from other reasons.

DISCUSSION

Vaccines were developed as a solution for the COVID-19 pandemic. Due to the urgent need for these vaccines, they were shortly after development given authorization for emergency use. The rapid pace of vaccine development and the uncertainty of potential long-term adverse effects raised some level of hesitation against vaccination in the global community, leading to the need for gathering information about their safety after being used publicly. This made long-term post-marketing surveillance data, particularly in high-risk vulnerable populations (elderly and those with chronic diseases) necessary to ensure the safety of COVID-19 vaccines.

After getting the ethical approval for this study, it was set out with the aim of investigating the safety of the COVID-19 vaccines used in Libya, especially regarding the side effects of these vaccines and their association with certain variables e.g., age, gender, and chronic diseases.

Generally, the study found that the COVID-19 vaccines` side effects were slightly higher in females. As females (59.8%) experienced significantly more fatigue compared to males (40.2%) (P=0.001). Also, headache, fever, dizziness, joint pain, breathing difficulty, nausea, pain, swelling, itching, and redness at the injection site were significantly more among females compared to males (P< 0.05). Even the severity of post-vaccine side effects was found to be significantly higher in females in comparison to males. This finding is consistent with that of Inoue and colleagues (2021) in Japan. In an online questionnaire-based survey, they investigated the presence of allergy and adverse reactions after vaccination. They found that female healthcare (HC) workers, who administered the first and second dose of the BNT162b2 mRNA COVID-19 vaccine, have shown significantly more frequency of fatigue, headache, chills, nausea, and muscle pain outside the injection site than males.[15] Many other observational studies from the US and Indonesia had also similar results that support our findings.[16,17]

The results of this study indicate that generalized side effects (e.g., general fatigue, joint pain, dizziness, and nausea) and local side effects e.g., pain at the injection site, were also significantly more prevalent in the younger age group (≤ 40 years), compared to the older age group (> 40 years) and even the severity of post-vaccine side effects was found to be significantly higher in this age group compared to the older age group. Also, fever was found to be significantly more prevalent among the ≤ 40 years (65.5%) and the > 40 years (34.5%) (P= 0.001). Comparable outcomes are seen in an observational study by Babamahmoodi and his colleges (2021) in Iran about the side effects and immunogenicity following administration of the Sputnik V COVID-19 vaccine in health care workers.[18]

Table 4. Association of participant's post-vaccination side effects with the type of the vaccine.

Side effect	No. (%)	Type of vaccine						P-value
		Sputnik V	AstraZeneca	Sinopharm	Sinovac	Pfizer	Moderna	
Fever	731(41.1)	346(47.3)	224(30.6)	80(10.9)	31(4.2)	41(5.6)	7 (1.0)	0.001
Headache	678(38.1)	322(47.5)	147(21.7)	107(15.8)	52 (7.7)	40(5.9)	7 (1.0)	0.061
General fatigue	665(37.4)	325(48.9)	189(28.4)	75(11.3)	28 (4.2)	37(5.6)	6 (0.9)	0.001
Pain at the injection site	594(33.4)	291(49.0)	138 (23.2)	83 (14.0)	28 (4.7)	43 (7.2)	6 (1.0)	0.001
Joint pain	326(18.3)	173(53.1)	92 (28.2)	31 (9.5)	13(4.0)	12 (3.7)	3 (0.9)	0.001
Swelling of the injection site	288(16.2)	145(50.3)	90 (31.3)	24 (8.3)	9(3.1)	17 (5.9)	2 (0.7)	0.001
Dizziness	197(11.1)	105(53.3)	48(24.4)	22(11.2)	2(1.0)	12(6.1)	3 (1.5)	0.001
Itching at the injection site	128(7.2)	60(46.9)	34(26.6)	15(11.7)	5(3.9)	6(4.7)	2(1.6)	0.001
Nausea	98(5.5)	48(49.0)	31(31.6)	(8.2) 8	4(4.1)	6(6.1)	(1.0) 1	0.040
Diarrhea	70(3.9)	(50.0)35	20(28.6)	(11.4)8	0 (0.0)	6 (8.6)	(0.0) 0	0.092
Redness at the injection site	67(3.8)	34(50.7)	21(31.3)	4(6.0)	0 (0.0)	6(9.0)	2(3.0)	0.003
Breathing difficulty	731(41.1)	346(47.3)	224(30.6)	80(10.9)	31(4.2)	41 (5.6)	7 (1.0)	0.001
Cough	678(38.1)	322(47.5)	147(21.7)	107(15.8)	52(7.7)	40 (5.9)	7 (1.0)	0.061
Vomiting	665(37.4)	325(48.9)	189(28.4)	75(11.3)	28(4.2)	37 (5.6)	6(0.9)	0.001
Allergic reaction	25 (1.4)	10 (40.0)	5 (20.0)	4 (16.0)	3 (12.0)	2 (8.0)	1 (4.0)	0.609*
Blood clot	4 (0.2)	0 (0.0)	3 (75.0)	1 (25.0)	0 (0.0)	0 (0.0)	0 (0.0)	0.283*

* Fischer exact test.

They have found that the most common side effect was pain in the injection site (56.9%), fatigue (50.9%), body pain (43.9%), headache (35.7%), fever (32.9%) joint pain (30.3%), chilling (29.8%) and drowsiness (20.3%). Furthermore, they found that side effects of the vaccine were significantly more frequent in females and younger individuals.[18] Another retrospective cross-sectional study by El-Shitany et al., (2021) about the side effects of Pfizer-BioNTech COVID-19 vaccine among Saudi residents, further supports these results, where they found flu-like symptoms to be more common among those under 60 years.[19]

A multi-center cross-sectional study was carried out in Germany and Czech Republic to evaluate the short-term side-effects of COVID-19 vaccines, in healthcare workers receiving the AstraZeneca vaccine. This study had some findings similar to our study, where the most common local side effect was injection site pain, and the most common systemic side effects were fatigue, muscle pain, chills, feeling unwell, nausea, and headache. The majority of these side effects resolved within 1-3 days. But in contrast to our study, the young age group (below 35 years old) was the least affected, and the side effects' frequency was insignificantly higher in females.[20] The authors of this study have suggested that this could be due to the small sample size of their study and they recommended that these differences should be further investigated in large-scale independent studies.

The previously COVID-19 infected people had more common side effects of COVID-19 vaccines than those not (78.5% and 21.5%, respectively; P=0.001). This finding supports the work of the Iranian study mentioned above, as participants with previous COVID-19 infection experienced a significantly higher rate of pain in the injection site and some systemic

Table 5. Association of participant's post-vaccination side effects with gender and age groups.

Side effect	No. (%)	Gender		P-value	Age		P-value
		Male	Female		≤ 40 years	>40 years	
		No. (%)	No. (%)		No. (%)	No. (%)	
Fever	731(41.1)	308(42.1)	423(57.9)	0.003*	479(65.5)	252(34.5)	0.001
Headache	678(38.1)	290 (42.8)	388 (57.2)	0.019	419(61.8)	259(38.2)	0.074
General fatigue	665(37.4)	267(40.2)	398(59.8)	0.001*	445(66.9)	220(33.1)	0.001*
Pain at the injection site	594(33.4)	212(35.7)	382(64.3)	0.001*	407(68.5)	187(31.5)	0.001*
Joint pain	326(18.3)	120(36.8)	206(63.2)	0.000*	209(64.1)	117(35.9)	0.046*
Swelling of the injection site	288(16.2)	103(35.8)	185(64.2)	0.001*	173(60.1)	115(39.9)	0.744*
Dizziness	197(11.1)	57(28.9)	140(71.1)	0.001*	130(66.0)	67(34.0)	0.038*
Itching at the injection site	128(7.2)	48(37.5)	80(62.5)	0.043*	72(56.3)	56(43.8)	0.515*
Nausea	98 (5.5)	32(32.7)	66(67.3)	0.006*	69(70.4)	29(29.6)	0.020*
Diarrhea	70 (3.9)	36 (51.4)	34(48.6)	0.394*	34(48.6)	36(51.4)	0.082*
Redness at the injection site	67 (3.8)	22 (32.8)	45(67.2)	0.025	44(65.7)	23(34.3)	0.311*
Breathing difficulty	65 (3.7)	21 (32.3)	44(67.7)	0.022*	44 (67.7)	21 (32.3)	0.159*
Cough	44 (2.5)	15 (34.1)	29(65.9)	0.125*	27 (61.4)	17 (38.6)	0.877*
Vomiting	32 (1.8)	11 (34.4)	21(65.6)	0.211*	15 (46.9)	32 (53.1)	0.203*
Allergic reaction	25 (1.4)	13 (52.0)	12(48.0)	0.687*	14 (56.0)	11(44.0)	0.838*
Blood clot	4 (0.2)	3 (75.0)	(25.0)1	0.342*	1 (25.0)	3 (75.0)	0.311*

*Fisher's exact test.

Table 6. Association of participant's post-vaccination side effects with gender and age groups.

Severity of Symptoms	No. (%)	Gender		P-value	Age		P-value
		Male	Female		≤ 40 years	>40 years	
		No. (%)	No. (%)		No. (%)	No. (%)	
Mild side Effects	792(60.0)	387(48.9)	405(51.1)		493(62.2)	299(37.8)	
Moderate side effects	446(34.0)	164(36.8)	282(63.2)	0.001	276(61.9)	170(38.1)	0.001
Severe side effects	88(6.0)	34 (38.6)	54 (61.4)		56 (63.6)	32 (36.4)	

However, some systemic side effect such as fever, headache, and joint pain were significantly less common in the participants with previous COVID-19 infection (P < 0.05).[18] Also the Riad et al.`s study reported that participants previously infected with COVID-19 reported more side effects.[20]

According to our results, no significant association was found among participants with chronic diseases, i.e., hypertension, diabetes mellitus, heart disease, and asthma, and the occurrence of the side effects of the COVID-19 vaccines (P>0.05). These results corroborate the findings of the work by Riad and his colleagues as they have also found that chronic illnesses and medical treatments were not associated with an increased risk of side effects incidence and frequency.[20]

The majority of the participants reported that they received the Sputnik V vaccine followed by the AstraZeneca, the Sinopharm and few received the Moderna vaccine. However, those who received the Moderna vaccine seem to be Libyans who have been vaccinated outside Libya, as this vaccine was not used in Libya. Moreover, less than half of the participants received the second dose of the vaccine, a few of them reported the type of vaccine, and more than two-thirds of those stated that they have received the AstraZeneca vaccine instead of the second dose of the Sputnik V vaccine. The reason for this is that the second dose of the Sputnik V vaccine was not available in Libya and those were given the Astra Zeneca vaccine instead.

However, a few of the participants have received the Pfizer vaccine, and of those 80.2% reported that they experienced side effects. This side effect profile is comparable to that mentioned according to the Center of Disease Control and Prevention (CDC), where among all vaccine recipients asked to complete diaries of their symptoms during 7 days after vaccination, 84.7% reported at least one local injection site reaction and 77.4% reported at least one systemic reaction.[21]

Generally, the frequency of side effects reported was more common among participants, who received the Sputnik V and the Sinopharm vaccine compared to other vaccines. This difference was found to be statistically significant (P=0.001). The most common side effect was fever for the Sputnik V vaccine. It has been shown that the Sputnik V vaccine 47.3% was significantly associated with higher reports of fever, general fatigue, joint pain, dizziness, nausea, pain, swelling, and itching at the injection site (P<0.05). A reason for this high percentage of side effects may be due to the high percentage of the participants who received these two vaccines. But also, in accordance with these results, a study by Logunov et al. (2021) have demonstrated that common adverse events such as flu-like illness and local reaction of participants in the vaccine group.[9] Another study by Jarynowski et. al. (2021) that is in line with these results, where they analyzed the social media content of Telegram via deep learning looking for adverse events (AEs) caused by the Sputnik V vaccine. They have found that Telegram users complained mostly about pain (47.43%), fever (46.57%), fatigue (33.54%), and headache (24.79%). Moreover, women reported more AEs than men (1.2-fold, P<.001).[22]

Eventually all of the reported side effects were self-limiting without any specialized care needed, except for 2.85% of the participants who reported being admitted to the hospital, for the severity of the symptoms. As (1.54%) suffered from shortness of breath, (0.3%) from blood clots, these clots appeared from the first week of the vaccination, and 27 (2.07%) reported being admitted for other reasons. This is also in accordance with earlier observations by Al Khames et. al. (2021) who found swelling and severe allergic reaction of the eyelids, severe hypotension, shortness of breath, acute hyperglycemia, and severe chest pain to be among the unusual signs and symptoms reported by the participants vaccinated.[23] Comparable numbers were also found in a study that aimed to evaluate the adverse effects following immunization (AEFIs) and analyze the potential associations based on the information from the Vaccine Adverse Effect Reporting System (VAERS) database. The results of this study calculated the outpatient and emergency room visit rates were 11.92 and 22.42% for AEFIs, and 2.53% of cases needed hospitalization.[24]

To our knowledge, this study has been one of the first in Libya about the side effects of the COVID-19 vaccines used in Libya. It has the advantage of large number of participants compared to other studies done in Libya so far, and also the inclusion of different vaccine types. Like any study it had some limitations, first, as part of the survey data was collected through an internet-based questionnaire, so symptoms and participants` medical history were self-reported. So particularly, it is unclear whether the diagnosis of diseases is correct. Another two limitations to be mentioned, were that we did not collect information about the history of allergies in the participants, and we did not differentiate between the side effects after the first and second dose.

CONCLUSION

The side effects of COVID-19 vaccines used in Libya are generally mild and self-limiting. The most common side effect was fever and it was more prominent among females and the younger age group. Also, the side effects due to the COVID-19 vaccine were more common among participants, who received the Sputnik V vaccine. But more information is needed focusing on different groups like pregnant and children, as vaccination campaigns still continue in Libya.

REFERENCES

1. World Health Organization. Draft Landscape and Tracker of COVID-19. Accessed January 31, 2022.
2. World Health Organization. Accessed January 30, 2022.
3. VIPER Group COVID19 Vaccine Tracker Team. (2022, February 28). COVID19 Vaccine Tracker. Accessed March 1, 2022.
4. National Center for Disease Control-Libya. Accessed February 14, 2022.
5. Polack FP, Thomas SJ, Kitchin N, Absalon J, Gurtman A, Lockhart S, et al. Safety and Efficacy of the BNT162b2 mRNA Covid-19 Vaccine. N Engl J Med. 2020;383:2603-2615.
6. Baden LR, El Sahly HM, Essink B, Kotloff K, Frey S, Novak R, et al. Efficacy and Safety of the mRNA-1273 SARS-CoV-2 Vaccine. N Engl J Med. 2021;384:403-416.
7. Falsey AR, Sobieszczyk ME, Hirsch I, Sproule S, Robb ML, Corey L, et al. Phase 3 Safety and Efficacy of AZD1222 (ChAdOx1 nCoV-19) Covid-19 Vaccine. N Engl J Med. 2021;385:2348-2360.
8. SAGE Working Group on COVID-19 vaccines. Evidence Assessment: Sinopharm/BBIBP COVID-19 vaccine. World health Organization. Accessed 1.31.2022.
9. Logunov DY, Dolzhikova IV, Shcheblyakov DV, Tukhvatulin AI, Zubkova OV, Dzharullaeva AS, et al. Safety and efficacy of an rAd26 and rAd5 vector-based heterologous prime-boost COVID-19 vaccine: an interim analysis of a randomised controlled phase 3 trial in Russia. Lancet. 2021;397:671-681.
10. Sadoff J, Gray G, Vandebosch A, Cárdenas V, Shukarev G, Grinsztejn B, et al. Safety and Efficacy of Single-Dose Ad26.COV2.S Vaccine against Covid-19. N Engl J Med. 2021;384:2187-2201.
11. Voysey M, Clemens SAC, Madhi SA, Weckx LY, Folegatti PM, Aley PK, et al. Safety and efficacy of the ChAdOx1 nCoV-19 vaccine (AZD1222) against SARS-CoV-2: an interim analysis of four randomised controlled trials in Brazil, South Africa, and the UK. Lancet. 2021;397:99-111.
12. Beatty AL, Peyser ND, Butcher XE, Cocohoba JM, Lin F, Olgin JE, et al. Analysis of COVID-19 Vaccine Type and Adverse Effects Following Vaccination. JAMA Netw Open. 2021;4:e2140364.
13. Kaur RJ, Dutta S, Charan J, Tandon A, Yadav D, Islam S, et al. Cardiovascular Adverse Events Reported from COVID-19 Vaccines: A Study Based on WHO Database. Int J Gen Med. 2021;14:3909-3927.
14. Raosoft.inc. (2004). Raosoft.inc. Accessed January 1, 2022.
15. Inoue S, Igarashi A, Morikane K, et al. Adverse reactions to BNT162b2 mRNA COVID-19 vaccine in medical staff with a history of allergy. Respir Investig. 2022;60:248-255.
16. Cohen D, Greenberg P, Formanowski B, Parikh P. Are COVID-19 mRNA vaccine side effects severe enough to cause missed work? Cross-sectional study of health care-associated workers. Medicine. 2022;101:e28839.
17. Wibowo J, Heriyanto RS, Wijovi F, Halim DA, Claudia C, Marcella E, et al. Factors associated with side effects of COVID-19 vaccine in Indonesia. Clin Exp Vaccine Res. 2022;11:89-95.
18. Babamahmoodi F, Saeedi M, Alizadeh-Navaei R, Hedayatizadeh-Omran A, Mousavi SA, Ovaise G, et.al. Side effects and Immunogenicity following administration of the Sputnik V COVID-19 vaccine in health care workers in Iran. Sci Rep. 2021;11:21464.
19. El-Shitany NA, Harakeh S, Badr-Eldin SM, Bagher AM, Eid B, Almukadi H, et al. Minor to Moderate Side Effects of Pfizer-BioNTech COVID-19 Vaccine Among Saudi Residents: A Retrospective Cross-Sectional Study. Int J Gen Med. 2021;14:1389-1401.
20. Riad A, Pokorná A, Mekhemar M, Conrad J, Klugarová J, Koščík M, Klugar M, et al. Safety of ChAdOx1 nCoV-19 Vaccine: Independent Evidence from Two EU States. Vaccines (Basel). 2021;9:673.
21. Center for Disease Control and Prevention. (2021, November 5). Pfizer-BioNTech COVID-19 Vaccine Reactions & Adverse Events. Accessed February 12, 2022.
22. Jarynowski A, Semenov A, Kamiński M, Belik V. Mild Adverse Events of Sputnik V Vaccine in Russia: Social Media Content Analysis of Telegram via Deep Learning. J Med Internet Res. 2021;23:e30529.
23. Aga QAAK , Alkhaffaf WH, Hatem TH, Nassir KF, Batineh Y, Dahham AT, et al. Safety of COVID-19 vaccines. J Med Virol. 2021;93:6588-6594.
24. Chen G, Li X, Sun M, Zhou Y, Zhou Y, Yin M, Zhao B, et al. COVID-19 mRNA Vaccines Are Generally Safe in the Short Term: A Vaccine Vigilance Real-World Study Says. Front Immunol. 2021;12:669010.